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Trey Hanbury

September 14, 2005

BY ELECTRONIC FILING

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
The Portals
445 Twelfth Street, S.W.
Washington, D.C. 20554

Re: WT Docket No. 04-356
Ex Parte Presentation

Dear Ms. Dortch:

On behalf of Sprint Nextel Corporation, Lawrence Krevor, Michael Ha, Harry Perlow, and I met yesterday with the Federal Communications Commission staff identified below. We discussed the attached presentation.

Under section 1.1206(b) of the Commission's rules, 47 C.F.R. § 1.1206(b), please associate this letter with the above-referenced dockets.

Sincerely,

/s/ Trey Hanbury

Trey Hanbury
Senior Counsel
Sprint Nextel Corporation

CC: Ron Chase
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H Block:
Allocating Valuable New PCS Spectrum in the Core PCS Bands without Causing Harmful Interference

Sprint Nextel Corporation
September 13, 2005

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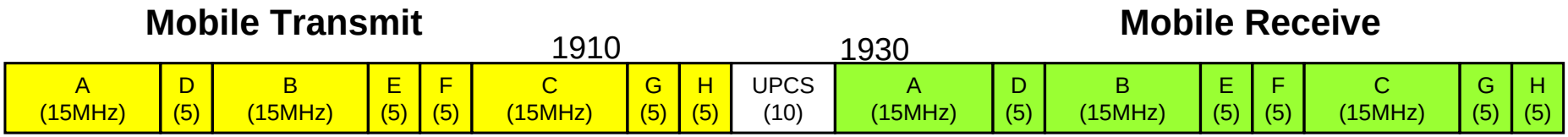
Priorities

1. Prevent harmful interference to other PCS blocks whether based on CDMA or GSM standards
2. Establish H Block as expansion spectrum for PCS or AWS use by making H Block resemble existing PCS blocks to the greatest extent possible
   - H Block can provide much-needed PCS expansion capacity in spectrum-constrained markets

H Block in Context



- **Major issue**: protect against harmful intermodulation interference into PCS B Block receive (only affects CDMA licensees in B Block Mobile Receive Band)
  - A result of characteristics of existing CMRS victim receive filters
  - Managed by requiring H Block to observe more stringent power limits (particularly in the upper portion of the H Block)
  - Managed by reliance on the relatively low probability of an interference event actually occurring under real-world conditions
- **Minor issue**: protect against harmful receiver overload interference into PCS mobile receive bands (affects both CDMA and GSM)
  - A result of characteristics of existing CMRS victim receive filters
  - Managed by requiring H Block to slightly limit mobile transmit power across the band (these protections are essentially subsumed by the extraordinary measures to protect against intermodulation interference
- **Little or no real issue**: protect against harmful out-of-band emissions interference into mobile receive bands (affects both CDMA and GSM)
  - A product of the H Block mobile transmit filter
  - Solved this problem by requiring H Block handsets to observe industry-standard OOBE limits

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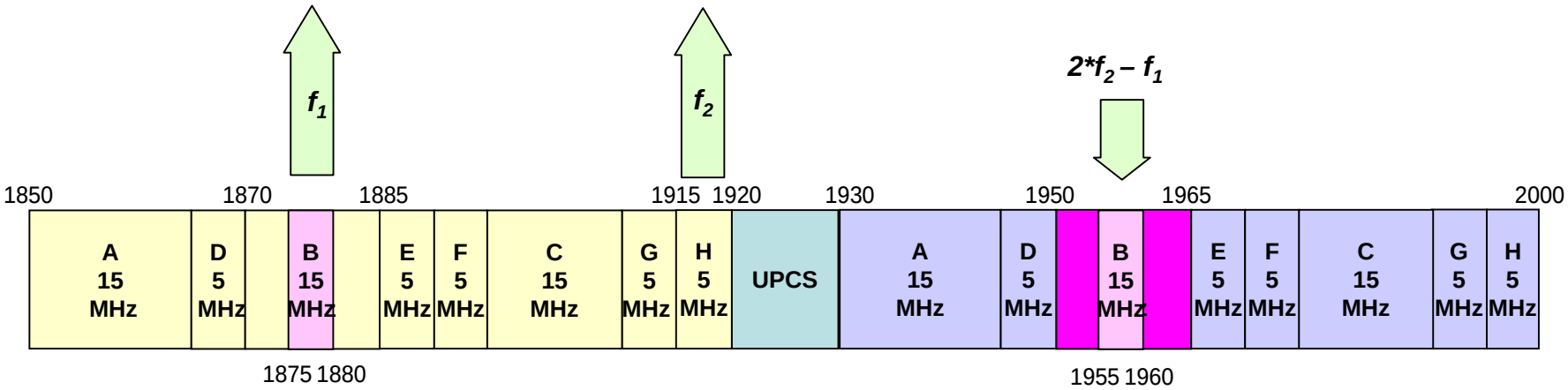
H Block Intermodulation Only Affects B Block Mobile Receive



	f_1	f_2	$2*f_2 - f_1$
B Block IM	1875 MHz	1915 MHz	1955 MHz
	1880 MHz	1920 MHz	1960 MHz

- Intermodulation requires two interfering signals
  - F1 is the own transmit signal
  - F2 is H block transmit signal
- PCS B Block mobile transmit and H Block mobile transmit create potential intermodulation interference to B Block mobile receive.
- H Block poses no other intermodulation risk to other PCS blocks.

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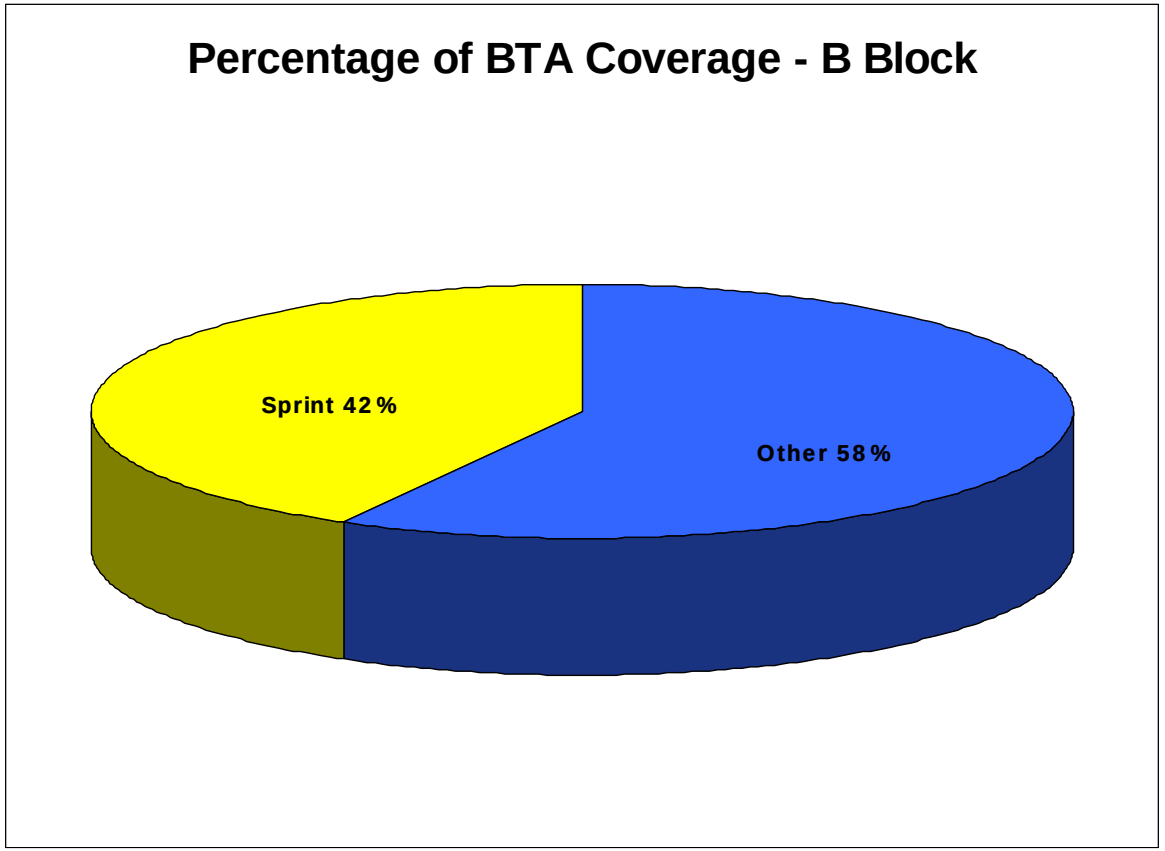
Sprint More Vulnerable to H Block Intermodulation Interference than Other Carriers

- Measured by BTA, Sprint Nextel holds nearly half of all B Block licenses – the only block vulnerable to IM interference from H Block
- As a percentage of coverage, 42% of Sprint services occur using B Block licenses
- Sprint's B Block licenses are also concentrated in some of the nation's most densely populated areas, where IM is most likely to occur



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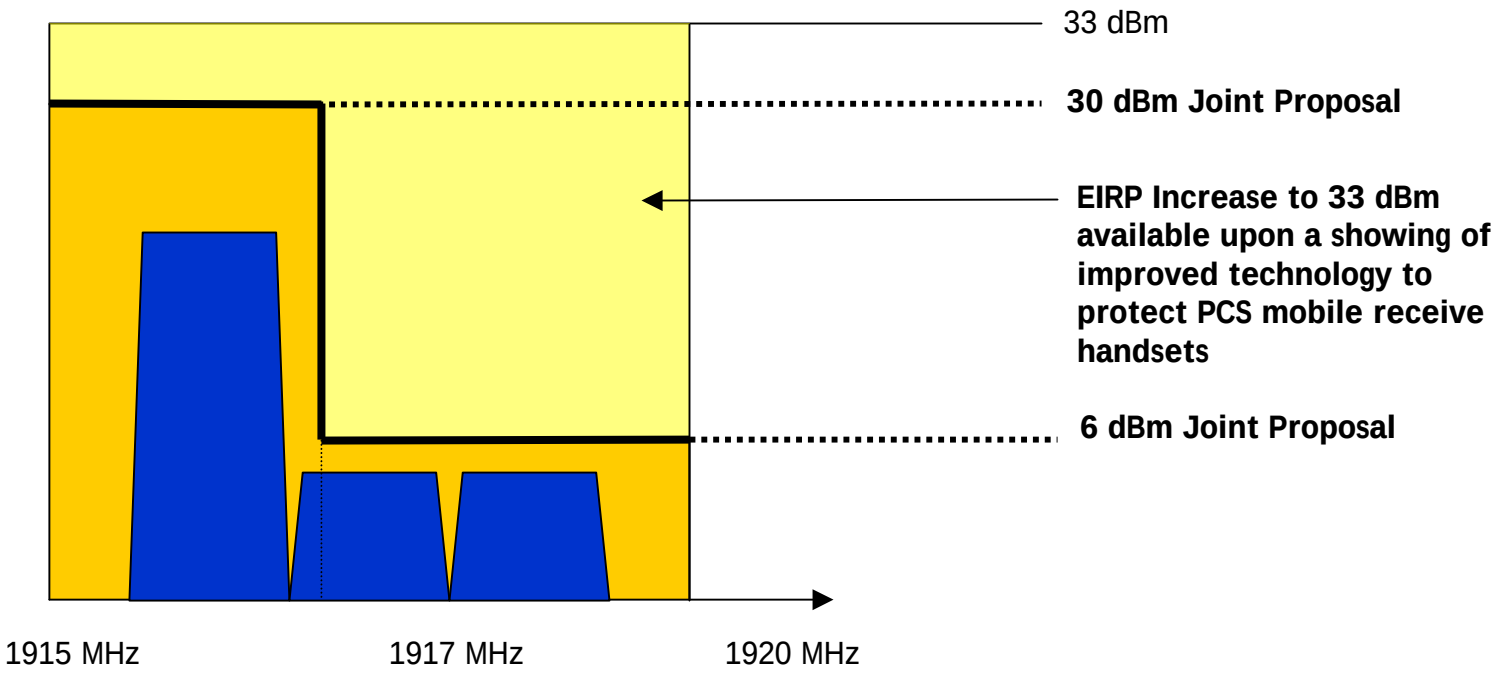
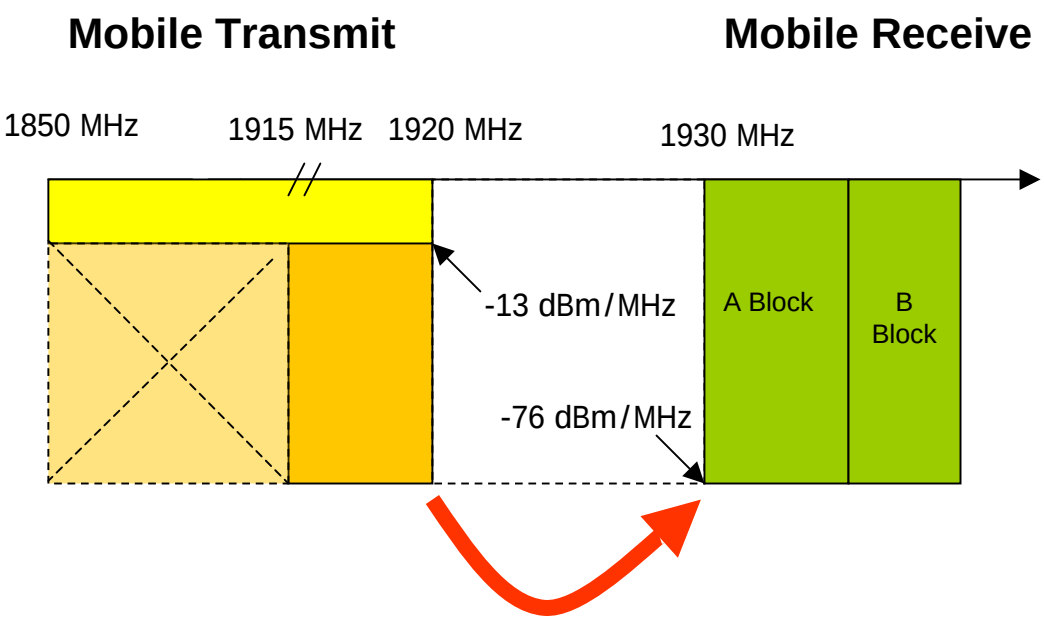
Solution: Intermodulation and Overload

- The February 8, 2005 Sprint-Nextel-Verizon Wireless joint proposal
  - Made EIRP limits context sensitive to prevent receiver overload and intermodulation into the mobile receive bands, particularly B Block
  - Provided a mechanism for future EIRP increases



Solution: Out-of-Band Emissions



- Originally Sprint-Nextel-Verizon Wireless proposed to incorporate industry-standard –76 dBm/MHz and apply to this limit to all new mobile transmit PCS Blocks A-H to avoid harmful emissions into A Block
- Emissions from Blocks A-G are not relevant to OOBE from H Block; therefore, we agree that the –76 dBm/MHz limit should apply only to the H Block at this time

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Interrogatories

1. **Power Limits.**
   a. If the CDMA carriers require 6 dBm in the upper portion of the H Block to protect against intermodulation interference, then why is 30 dBm acceptable in the lower portion of the CDMA block?
   b. Other carriers in this proceeding have proposed a power limit of 13 dBm in the upper portion of the H Block. Would 13 dBm be acceptable? Why not?
2. **Filtering Technology.**
   a. What percentage of FBAR filters exist as a total percentage of CDMA handsets?
   b. What percentage of SAW filters exist as a total percentage of CDMA handsets?
   c. How do the carriers expect these values to change over time?
3. **Single Conversion and Dual Conversion Handsets.**
   a. What percentage of single-conversion handsets exist as a total percentage of CDMA handsets?
   b. What percentage of dual-conversion handsets exist as a total percentage of CDMA handsets?
   c. How do the carriers expect these values to change over time?
4. **Probability Analysis.** Several factors need to occur simultaneously for interference to occur. Provide additional information to allow the FCC to better understand the probabilities that all the interference factors might occur simultaneously.
5. **Out of Band Emissions Limits.** The Verizon-Nextel-Sprint joint comments proposed an OOBE limit of -76 dBm/MHz RMS. Are alternative OOBE limits available that would recognize differences in switched technologies but still protect against harmful interference?

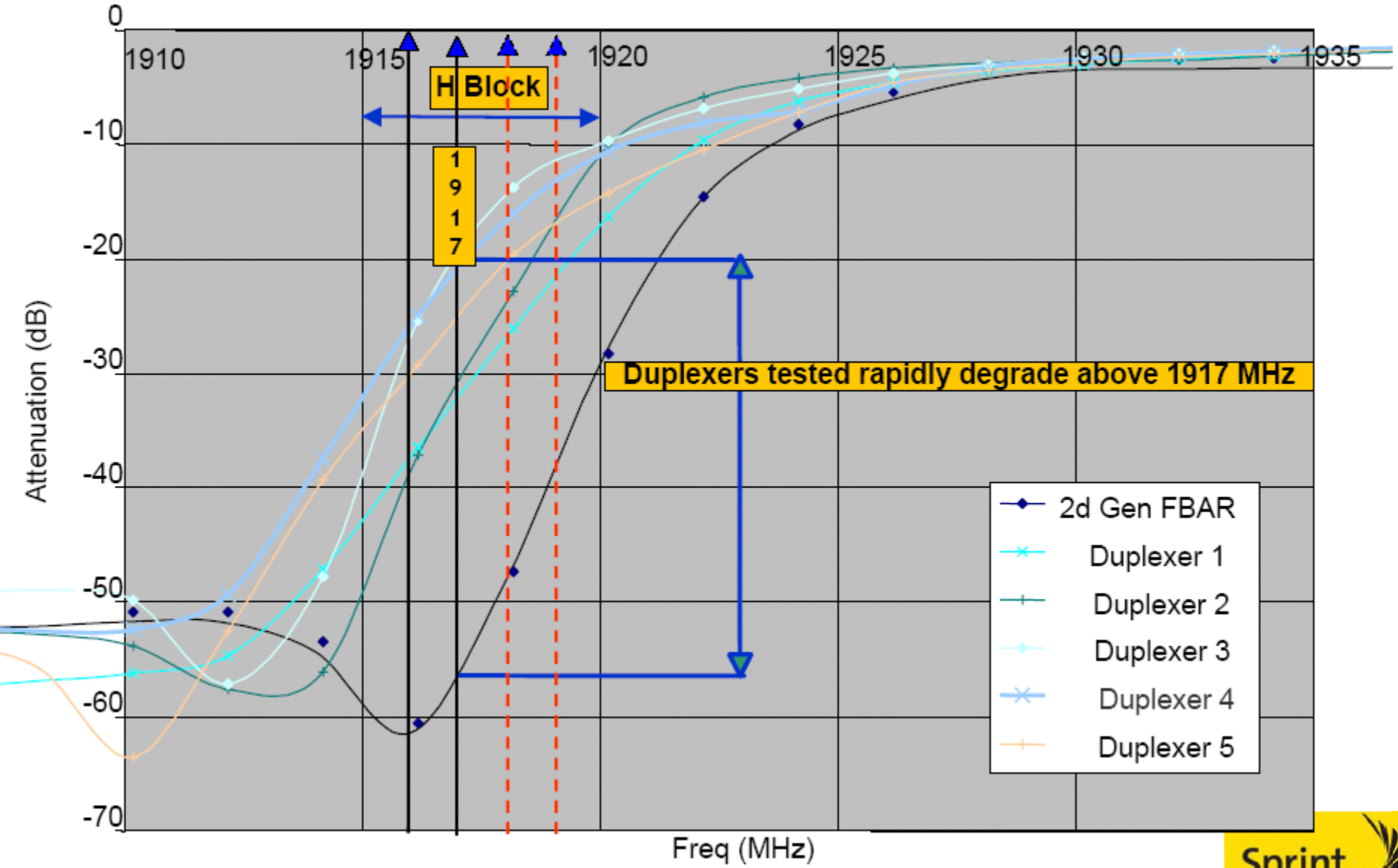
1. Power Limits

Question 1: *If the CDMA carriers require 6 dBm in the upper portion of the H Block to protect against intermodulation interference, then why is 30 dBm acceptable in the lower portion of the CDMA block? Other carriers in this proceeding have proposed a power limit of 13 dBm in the upper portion of the H Block. Would 13 dBm be acceptable? Why not?*

Answer:

- A flat power limit creates interference without achieving all available efficiencies
  - Intermodulation (IM) and receiver overload interference are the principal limiting factors of H block transmit power
- Extensive industry and independent testing demonstrates that the level of tolerable H block transmit power for various handsets ***slopes down*** from 1915 MHz to 1920 MHz
  - Different types of handsets have different downward sloping curve that can vary depending on handset temperature and operating conditions, but all handsets can operate at greater power closer to 1915 MHz than they can at 1920 MHz.
- Manufacturers and carriers cannot program handsets to respond perfectly to the precise contours of this sloped curve; more importantly, they do not need to program handsets to respond perfectly because in this case real-world interference events require numerous independent circumstances to occur simultaneously
  - Creating a two-step transmit power limit with 30 dBm for lower 2 MHz of the block and 6 dBm for the upper 3 MHz tracks the downward sloping curve of tolerable operating power in the 1915-1920 MHz in a manner that is workable for manufacturers and carriers
  - A fixed power limit of 13 dBm across the entire band would sacrifice useful spectrum at 1915-1917 MHz while emissions from 1917-1920 MHz would cause service-disrupting interference to millions of CDMA B Block mobile receive handsets

Duplexer Observations



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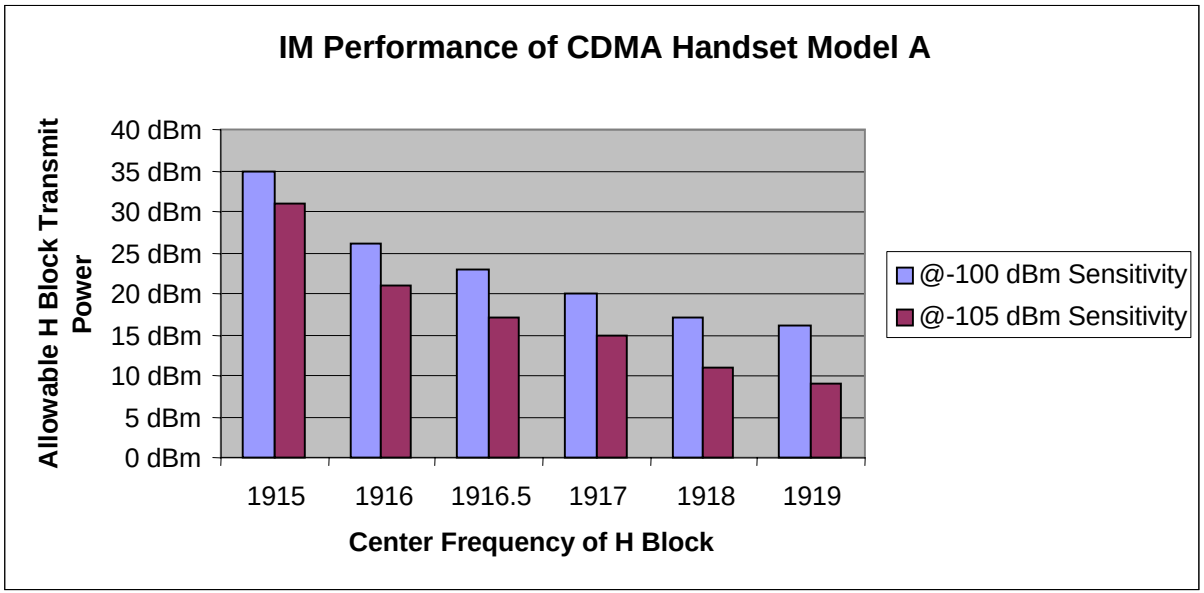
Maximize Usefulness without Interference

- Filter performance characteristics for all phones are the strongest in the 1915-1917 MHz band and weakest in the 1917-1920 MHz band; test data and filter performance plots support this conclusion.
- Placed on notice of a higher limit of 30 dBm, carriers in the A and B Blocks, including Sprint Nextel, can encourage manufacturers to strengthen their mobile receiver performance characteristics over time; doing so will allow even more intensive and more efficient use of the H Block spectrum (viz., performance above 30 dBm, up to 33 dBm).

Maximize Usefulness without Interference

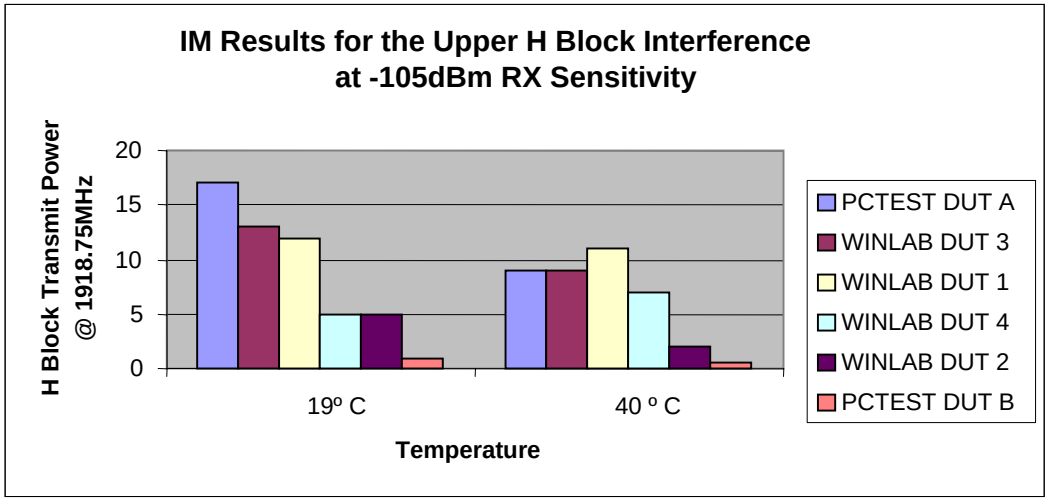
- CTIA did not conduct measurements in the lower portion of H block because the duplexer filters of all PCS mobile receive handsets achieve far better performance below 1917 MHz than they do above 1917 MHz
- Sprint's internal testing indicates that one of the worst performing handsets on the market can tolerate more than 30dBm of transmit power at 1915 MHz due to the sharp duplexer roll off of PCS mobile receive handsets



- Performance improvements are likely and offer the prospect of still higher power limits in the future

Maximize Usefulness without Interference

- The worst performing duplexer is the first generation FBAR filter
- Approximately 33% - 66% of current CDMA handsets use this filter according to Agilent.



- Sprint today has at least 5.8 million deployed handsets that perform similar to “PC TEST DUT B” in the graphic above.
  - These estimates are based only on the handsets that Sprint has tested; more previously purchased consumer handsets may be sold from inventory and others may have similarly poor performance because many other models from the same manufacturer have not been tested.
- H Block transmitters must protect incumbent PCS handsets especially when most H block handsets are expected to transmit at the maximum allowed power of 6 dBm

2. Filtering Technology

Question 2: What percentage of FBAR filters exist as a total percentage of CDMA handsets? What percentage of SAW filters exist as a total percentage of CDMA handsets? How do the carriers expect these values to change over time?

- Handsets with FBAR filters are estimated to comprise approximately 25% to 50% of handsets and this percentage is increasing rapidly.
- Handsets with SAW filters are estimated to comprise less than 25% of handsets and the percentage of handsets with SAW filters is decreasing over time.
- Sprint anticipates that most new mobile handsets will incorporate next-generation FBAR filters; however, Sprint will continue to provide service to millions of customers who hold handsets with older filter technology.
- The FCC will play a major role in determining the types of filters deployed.

3. Single and Dual Conversion Handsets

Question 3: *What percentage of single-conversion handsets (aka "direct conversion" or "zero intermediate frequency" handsets) exist as a total percentage of CDMA handsets? What percentage of dual-conversion (aka super-hetrodyne) handsets exist as a total percentage of CDMA handsets? How do the carriers expect these values to change over time?*

- Deployed handsets in Sprint's network are almost evenly split between those that use single-conversion technology and those that use dual-conversion technology.
- Sprint no longer purchases dual-conversion handsets and sells few, if any, dual-conversion handsets today.
- Handsets with single-conversion receivers are expected to increase to the point where single-conversion handsets comprise approximately 80% of all handsets in two to three years depending on churn rates and other factors

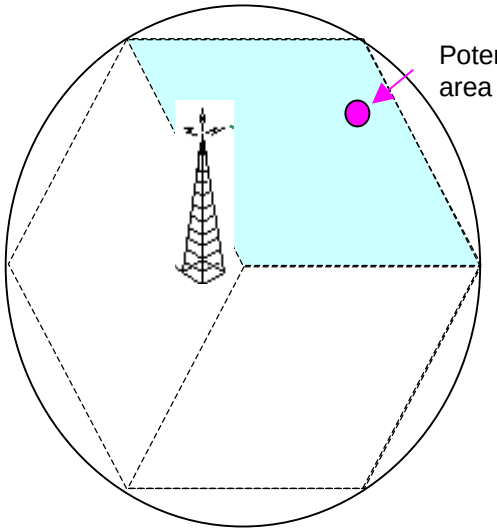
4. Probability Analysis

Question 4: *Several factors need to occur simultaneously for interference to occur. Provide additional information to allow the FCC to better understand the probabilities that all the interference factors might occur simultaneously.*

- There are four major factors to consider in the probability analysis
  - Power Probability. H block handset must transmit at full power.
  - Sensitivity Probability. Victim handsets must be at maximum sensitivity.
  - Proximity Probability. Both handsets must be within very close proximity of one another.
  - Simultaneity Probability. The above-three conditions must all exist simultaneously
- We have performed a simplified interference probability analysis using the following assumptions

Probability Factors	Assumptions
Power Probability	Maximum transmit power and maximum sensitivity level are assumed.
Sensitivity Probability	
Proximity Probability	Uniform distribution is assumed for simplicity.
Simultaneity Probability	Mobiles (victim and aggressors) are engaged in a call simultaneously

Probability Analysis - Assumptions

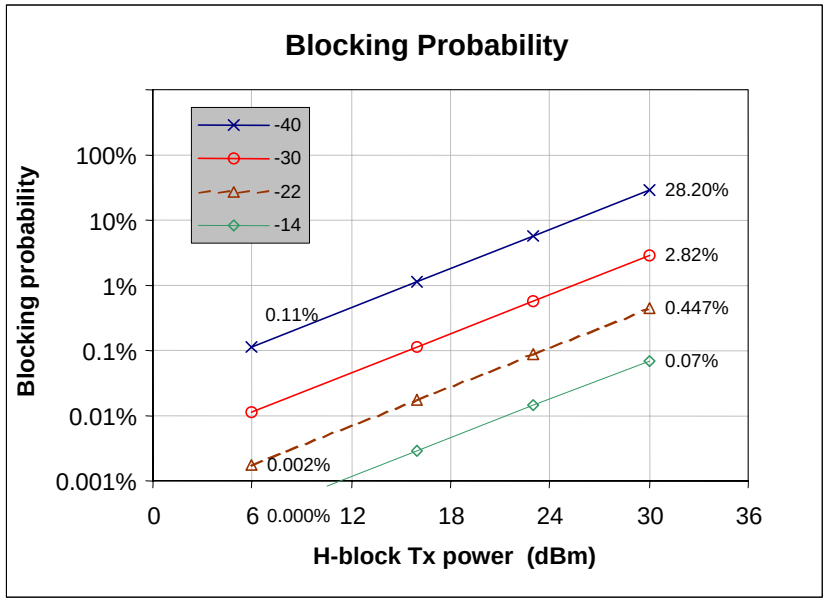


Assumptions	
Radius	500 m
Area (one sector)	26,200 m^2
# of Aggressors	30
# of Victims	300

- Isolation distance was calculated based on free space path loss at 2 GHz
- Four receiver types are modeled to represent various blocking performance
- Three levels of H block transmit power are modeled
  - +6 dBm, +23 dBm, +30dBm

Bands	Blocking Performance at Victim Handset	Blocking Performance at H Block Handset
Upper 3MHz	-40 dBm	+1 dBm
	-30 dBm	+11 dBm
Lower 2MHz	-22 dBm	+19 dBm
	-14 dBm	+27 dBm

Probability Analysis - Results



- Presented above is a simplified probability analysis indicating the average number of blocked victims for the 1917-1920 MHz band (blue and red curves) and for the 1915-1917 MHz band (brown and green curves)
- Based on the assumptions stated earlier, the lower portion of the band can tolerate higher H block transmit power whereas the upper portion of the band should be limited to much lower H block transmit power
- When evaluating the level of reliance on a probability analysis, the magnitude of the harm must also be considered.
  - Receiver Overload
  - Intermodulation Interference

5. Out-of-Band Emissions

Question 5: *The Verizon-Nextel-Sprint joint comments proposed an OOBE limit of -76 dBm/MHz RMS. Are alternative OOBE limits available that would recognize differences in switched technologies but still protect against harmful interference?*

Answer:

- Sprint-Nextel propose –76 dBm/MHz only for new H Block handsets.
  - CDMA is an always-on frequency division multiple access technology and requires an OOBE limit of –76 dBm/MHz simply to protect its own receiver from self jamming
    - Manufacturers of handsets and filter have stated that they can achieve a -76 dBm/MHz for H Block transmitters
    - Any additional expense associated with achieving –76 dBm/MHz can be built into new entrants' competitive bidding plan.
  - GSM is an intermittent-operation time-division multiple access technology
    - While the precise number of timeslots can vary, GSM handsets use an average of only 1 of 8 available time slots for the majority of traffic.
    - Applying a 9 dB time domain correction factor (10*Log 8 slots = 9.03 dB) to account for the prevailing time-division would allow GSM handsets that comply with a -67 dBm/MHz at 1930 MHz to effectively meet the –76 dBm/MHz limit that should apply to the entire band to protect against harmful interference to incumbent PCS licensees.